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The disposal of waste, containing organic material, in landfills results in landfill gas (LFG) generation. LFG consists of methane (55-60 %) and carbon dioxide (40-45 %). Estimates of methane emissions are required for national greenhouse gas inventories. One approach for quantification of whole landfill site emission is the tracer dispersion method. The objective of this study was to quantify methane emissions from two Danish landfills, using the tracer dispersion method.

The tracer dispersion method is based on the assumption that the landfill methane and a continuously released tracer gas (acetylene in this study) will disperse in the same way in the atmosphere. Methane emissions can be quantified by performing several traverses downwind perpendicular to the plume from the landfill while measuring the atmospheric concentration of methane and tracer gas. Gas concentrations were measured by a $C_2H_2/CH_4/H_2O$ analyzer (G2203, Picarro, Inc., Santa Clara, CA) based on Cavity Ring-Down Spectroscopy (CRDS). Two measurement campaigns were performed on January 14 and March 15, 2016. Figure 1 shows methane and tracer gas plumes measured downwind of the landfills.

Figure 1. Methane (red) and tracer gas (yellow) plumes measured downwind of the landfills. The orange triangles indicate the tracer gas release locations.

The total methane emissions from both landfills were 49.6 and 45.8 kg CH_4/h on January 14 and March 15, respectively, which equals 10,400 ton CO_2eq/year. The lower emission rate measured on March 15 in comparison to January 14 was most likely due to increasing barometric pressure on March 15. Methane emission from the composting plant was 18.9 kg/h on January 14; and was not distinguishable on March 15.

The measured methane emission rates indicate that there is a high potential for mitigation of methane emission and optimization of gas collection efficiency at the landfills. The methane oxidation and collection rates were not quantified in this study and remain a future topic to be studied. Quantification of the methane oxidation and the gas collection rate is necessary in order to calculate the gas collection efficiency and develop a plan for optimization of methane collection and mitigation of methane emission.